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5G-System Bearer Offloading for Dual Connectivity for RAN

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Abstract

This document attempts the case for new work that needs to be developed for 5G users to improve faster download and upload of the user's data in a scenario of dual-connectivity 3GPP access outlining the poor radio coverage issues. This document also outlines the faster user data mechanism accompanying 3GPP access of 5G user device via bearer offloading in case of a poor coverage.

Status of This Memo

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This Internet-Draft will expire on December 7, 2018

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1. Introduction

5G system has been evolved to serve the user in more efficient way of meeting higher download and upload of user data for 5G Users accessing the network via wireline and wireless, in addition to Residential Gateway RG and IoT support. In 5G system Access and user experience is challenging for poor radio coverage (for both wi-fi and RAN) and the proposal in this document addresses to the problem of dual-connectivity of 3GPP access with Master-gNB having poor coverage.

2. Conventions and Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [1].

3. User data flow for Dual Connectivity for 3GPP access and problem statement

3.1 5G system architecture

A simplified 5G-system architecture shown in Figure-1 in the case of UE in non-roaming scenario with RAN access(3GPP).

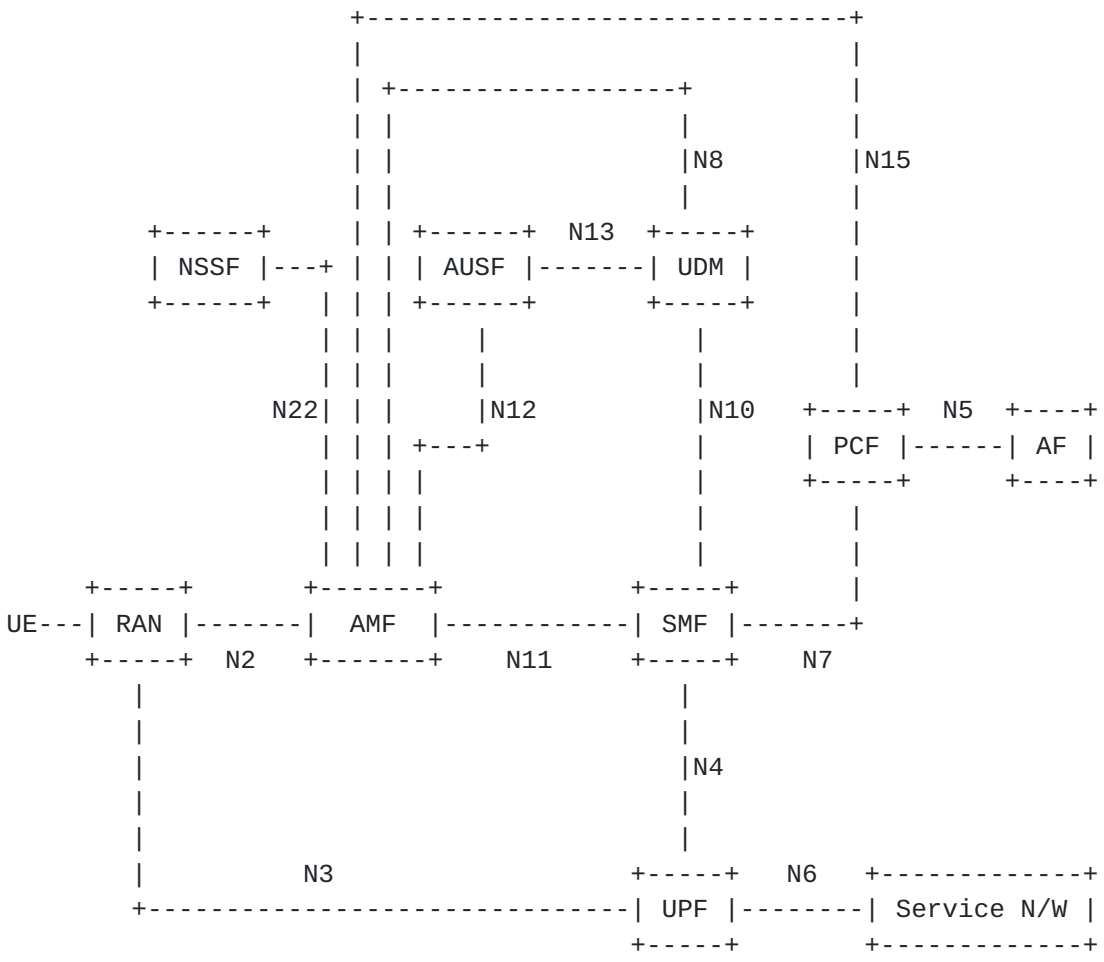

Figure 1 : Simplified 5G-system Architecture for RAN access

For clarity in the current document proposal, multiple node/ function like UDSF, NRF, and interfaces N9, N14 are not shown.

3.2 QoS

QFI is defined as Qos Flow ID is an identity to QoS flow in the 5G system. All data traffic within a PDU session are labelled or identified by QFI, it implies same QFI labelled data flow will receive same traffic forwarding treatment like scheduling, priority etc.

Data flow is via N3 (N3 and N9) interface, being encapsulated end-to-end. This flow is controlled by SMF, who provides QoS profile during session establishment to R(AN) and provide the PDR to the UPF. Please Note that like 4G system, default QoS flow is applied to each PDU session and retain till lifetime span of connectivity. In case of non-3GPP access QFI is delivered to N3IWF entity (or NG-RAN) for

every time User Plane of the PDU session is established, modified or activated.

3.3 Dual Connectivity

Dual connectivity (DC) concept developed for 3GPP access, functional support the network to make use of additional radio resource to achieve required throughput in downlink and uplink of user data. This was introduced in 4G system support 5G data speed by addition of dual connectivity of UE with eNBs , master eNB and Secondary eNB and /or eNodeB in congestion with gNB. This is achieved by addition of Secondary eNodeB to the Master eNodeB. Master-eNB has full control to add, delete and HO (handover) of eNodeBs as and when needed.

3.4 Problem Statement

Problem statement 1: Inspite in a Dual connectivity of 5G system user experience is impacted because of Master-gNB may have degrade radio condition and another Master-gNB is not available for handover where as Secondary-gNB is available with sufficient radio resource.

4. Proposal of Bearer Offloading Dual-Connectivity with 3GPP access

The solution proposed in this document to solve the degrade Rf condition at Master-gNB while handover to another Master-gNB is not possible and UE have better or improved Rf condition with Secondary-gNB(as compared to Master-gNB).

Figure 2, show below shows how radio resource control can be handed over from Master-gNB to Secondary-gNB.

- 5G user (UE) is being served by Master-gNB
- Master-gNB adds Secondary-gNB for delivering user data to UE
- UE is register to 5G-core via Master-gNB , whereas there is no user context available between Secondary-gNB and AMF
- There is X2 interface between master-gNB and Secondary-gNB defined in 3GPP specification.
- User data is deliver over N3 interface between UPF and Master-gNB
- Master-gNB splits the partial User data over x2 interface to Secondary-gNB.

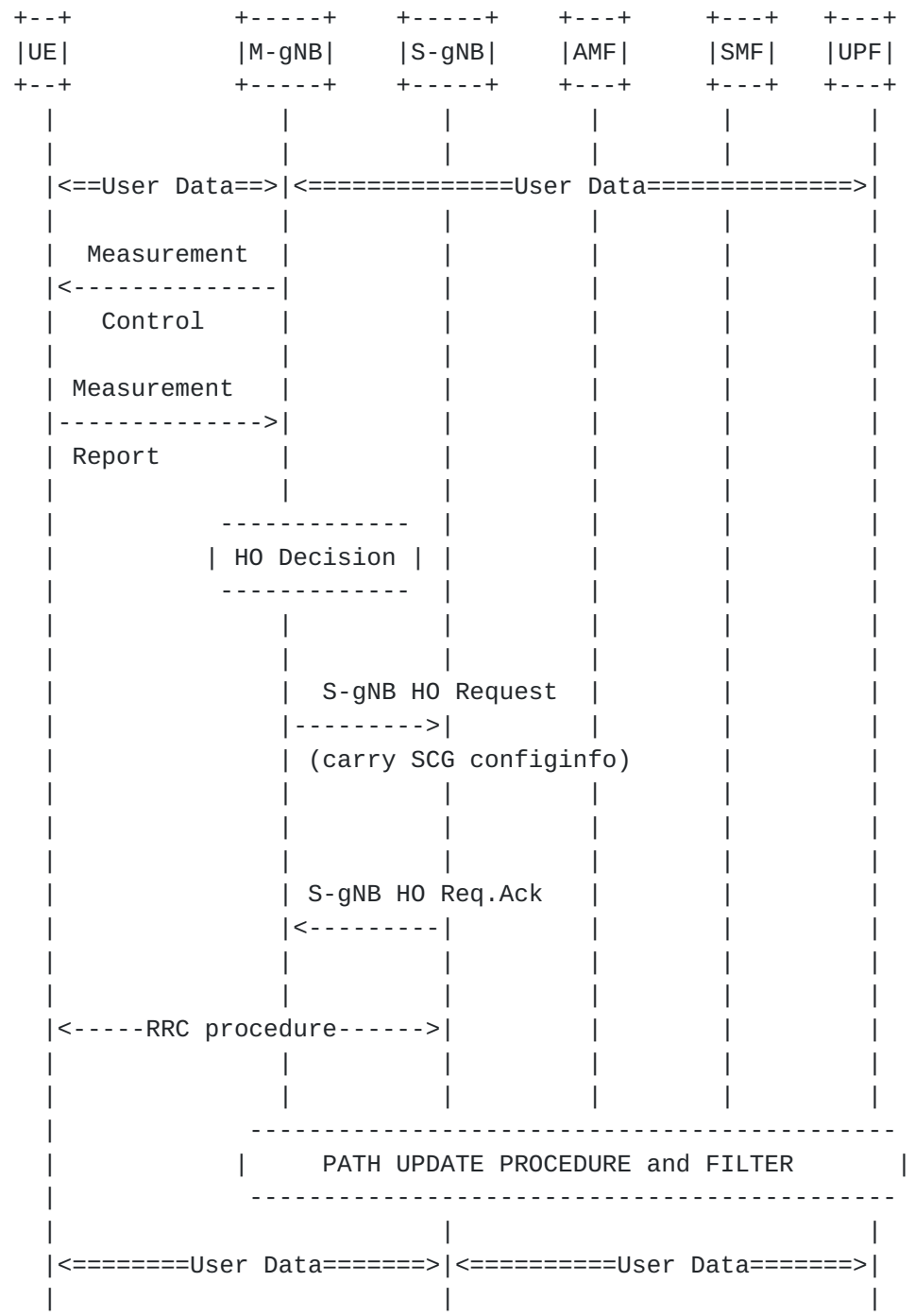

Figure 2: Bearer Offloading Dual-Connectivity with 3GPP access only

- Based on Measurement report, Master-gNB take decision to execute a procedure of handover to Secondary-gNB with SCG configuration.
- Secondary-gNB establish connection with AMF to cater user's all signalling and data traffic.
- Master-gNB also provides a radio (Rf) bearer splitting template termed as 'FILTER'. This bearer template FILTER is delivered to

UPF via SMF.

- UPF now shift the user data on N3 interface from Master-gNB to Secondary-gNB. This Secondary-gNB will act as new Master-gNB.

Please note that this FILTER value in this scenario of handover from Master-gNB to Secondary-gNB MUST empty or NULL, implies that user traffic segregation is completely governed by AMF and SMF based on PCC rules and policies.

5. IANA Considerations

None.

6. Security Considerations

Security considerations related to the 5G systems are discussed in [NGMN]. Due to the request for intrinsic realization of security such aspects have to be considered by design for architecture and protocols.

Especially as a joint usage of resources and network functions by different separate logical network slices (e.g. in terms of virtual network functions) seems to be inevitable in the framework of 5G the need for strong security measures in such an environment is a major challenge.

7. Privacy Considerations

Support of full privacy of the users (customers and tenants / end service providers) is a basic feature of the next generation trusted and reliable communications offering system. Such a high degree of ensured privacy shall be reflected in the proposed architecture and protocol solutions.

Especially as Identifiers and mapping of locators to them are addressed some privacy concerns arise. Mobility solutions tend to expose unique identifiers. A solution inside the mobile network exposes these identifiers to the network operator, which is not a big deal since the network operator already has information about the device's location. In contrast, an IP level solution exposes both the identifiers and the locations at the IP layer. That means that web sites, for example, can now track the device's successive locations by watching the IP address. Solutions such as transporting the identifiers not as part of the IP header should be considered.

8. Acknowledgements

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Comments, constructive critisms from Karthik Palaniswamy and Nagesh V. J. are respectfully acknowledged.

9. References

9.1. Normative References

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